

# Fishes of Khasi Hills, Meghalaya (India), with observations on their distributional pattern<sup>1</sup>

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## INTRODUCTION

The fish-fauna of Khasi Hills is very poorly known. Perusal of literature shows that altogether 15 species are on record from these hills (see McClelland 1842; Day 1889; Sehegal 1959, Yazdani & Chanda 1971 and Yazdani 1972). Menon (1962) reported 161 species from Brahmaputra drainage which also include the drainages of the Khasi Hills. This indicates that the species known so far from Khasi Hills constitute a very small percentage of its fish-fauna.

Khasi Hills is one of the three districts namely, Khasi, Jaintia and Garo Hills of the newly formed state of Meghalaya of the Indian Union. The greater part of this hill district is like a plateau which consists of blocks of flat or gently undulating land separated by narrow ravines and deep valleys. This plateau is remarkably abrupt on its southern face but on its northern edge it gradually slopes towards the Brahmaputra valley. Its height varies from around 3,000 ft (914 metres) to 6,000 ft (1828 metres). The vegetation of this hill is luxuriant due to heavy rainfall, bamboo and pine forests covering a large tract. The upper and more level parts of the hill are

however thickly carpeted with grass. The beds of streams and rivers are generally rocky and full of gravel. The water current is swift and after a heavy rainfall most of the streams become torrential.

The material on which this paper is based had accumulated at the Eastern Regional Station, Zoological Survey of India, Shillong during the past twelve years (1960 to 1971). It had been brought by field parties in all seasons of the year as a result of routine faunistic surveys of streams, tanks and lakes in the Khasi Hills. For collecting this material, bag nets were used for small fishes and cast nets for larger forms.

The material contained 29 species which are dealt with in this paper. Only 8 species, out of 15 species reported earlier from Khasi Hills, have not been found. They are: *Puntius ticto* (Ham.), *Puntius sophore* (Ham.) (Cyprinidae), *Balitora brucei* Gray (Homalopteridae), *Botia almorhae* Day, *Somileptes gongta* (Ham.) (Cobitidae), *Pseudoecheneis sulcatus* (McClelland) (Sisoridae), *Olyra longicauda* McClelland, *Olyra laticeps* (McClelland) (Olyridae).

Some observations on the distributional pattern of fishes in the Khasi Hills have also been given in the paper. An attempt is made to explain differences in the fish-fauna between dif-

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ferent streams and lakes on the basis of differences in the habitats and habits of species. The term habitat refers to only field observations like topography, flow of water and nature of bottom of the streams and lake.

#### Collection Localities

A total of 35 collecting localities are listed below. They have been arranged according to their altitude in two groups namely, group I representing localities between altitudes 3,000 and 4,000 ft and group II covering localities between altitudes 4,500 and 5,500 ft. This grouping is based on the fact that the number of species in the Khasi Hills shows a marked decline at elevations over 4,000 ft.

#### Group I:

1. Umshing stream. 2. Sumer stream. 3. Umiuh stream. 4. Umran stream. 5. Umtham stream. 6. Umsning stream. 7. Nongpoh stream. 8. Lailad stream. 9. Barapani lake. 10. Mawroh stream. 11. Decam stream. 12. Weiloi stream. 13. Sohiong stream. 14. Synrangmowrah stream. 15. Mairang stream. 16. Cherrapunjee stream. 17. Mawblang stream. 18. Mawsomai stream.

#### Group II:

19. Mawlai stream. 20. Pologround stream. 21. Mawpat stream. 22. Botanical garden stream. 23. Golf ling stream. 24. Lawsohtun stream. 25. Bishnupur stream. 26. Fruit-garden stream. 27. Motinagar stream. 28. Satifalls stream. 29. Lalchand basti stream. 30. Upper Shillong stream. 31. Lady Hyderi Park tank. 32. Myllem stream. 33. Lailynkut stream. 34. Mawphlang stream. 35. Umtyngar stream.

### SYSTEMATIC ACCOUNT

A systematic account of 29 species from Khasi Hills is given below. The numbers for localities referred under each species correspond to those of the 'collecting localities'. The relevant information about the identity and

geographical distribution of species have been obtained from published literature namely, Day (1889), Shaw & Shebbeare (1938), Misra (1962) and Menon (1964) and that of habits is based solely on my own observations in the field. The general classification adopted here is that of Greenwood, Rosen, Weitzman & Myers (1966).

#### Order Cypriniformes

#### Family CYPRINIDAE

#### 1. *Accrossocheilus hexagonolepis* (McClelland)

1839. *Barbus hexagonolepis* McClelland, *Asiat. Res.*, 19, pp. 270, pl. 41, fig. 3.

*Material*: 218 examples, 15 to 120 mm in total length, from two different localities namely, nos. 2 and 9 were examined.

*Distribution*: Khasi Hills: first record. Elsewhere: India: Assam, W. Bengal and Eastern Himalayas; Nepal, Bangladesh, Malaya, Malay Archipelago, Burma and Thailand.

*Habits*: *A. hexagonolepis* is more common in the lake than in streams. It takes bait and is commonly caught by angling.

*Remarks*: Only juveniles of this species are present in the collection.

#### 2. *Cyprinus carpio* Linnaeus

1758. *Cyprinus carpio* Linnaeus, *Syst. Nat.*, ed. 10, Vol. 1.

*Material*: 1 example, 125 mm in total length, from one locality (no. 3) was examined.

*Distribution*: Khasi Hills: first record. Introduced in ponds in India. Original home is China and Japan.

*Remarks*: This species is being cultured in artificial ponds in Shillong by the Fisheries Dept., Govt. of Meghalaya.

#### 3. *Danio (Danio) aequipinnatus* (McClelland)

1839. *Perilampus aequipinnatus* McClelland, *Asiat. Res.*, 19, p. 393, pl. 60, fig. 1.

*Material*: 87 examples, 15 to 77 mm in total

length, from six different localities (nos. 4, 5, 6, 8, 16 and 17) were examined.

**Distribution:** Khasi Hills: first record. Elsewhere: India; Sri Lanka, Burma, Thailand and Bangladesh.

**Habits:** Compared to other species of *Danio*, *D. aequipinnatus* is rather uncommon in the Khasi Hills. Generally, it occurs with *D. dangila* and lives near the edges of streams. It does not occur at altitudes over 3,500 ft.

**Remarks:** In the Khasi Hills, the specimens of *D. aequipinnatus* show a marked tendency towards reduction in number of dorsal and anal rays and decrease in proportion of body depth. The dorsal rays vary from 12-13 (vs 12-16) and anal 13-15 (vs 14-18). The body depth in total length varies from  $4\frac{1}{2}$  to 5 (vs  $3\frac{3}{4}$  to  $4\frac{1}{2}$ ). The longest specimen recorded in this hill is 77 mm against 152 mm the maximum length known for this species (see Misra 1962).

#### 4. *Danio (Danio) dangila* (Hamilton)

1822. *Cyprinus dangila* Hamilton, *Fish Ganges*, pp. 321, 390.

**Material:** 630 examples, 13 to 82 mm in total length, from eighteen localities (nos. 1, 2, 4, 6, 9, 10, 11, 13, 20, 21, 23, 26, 27, 29, 31, 32, 34 and 35) were examined.

**Distribution:** Khasi Hills, and Shillong (Sehegal 1959). Elsewhere: India: Manipur, Nagaland, Assam, West Bengal and Bihar; Burma.

**Habits:** *D. dangila* is the most common species in the streams and lake of Khasi Hills and unlike *D. aequipinnatus* it occurs upto 5,000 ft (1524 metres) altitude. It is more commonly found with *D. rerio* (Ham.) than with *D. aequipinnatus* and prefers to live near the edges of streams. Its members swim in shoals near the surface of water.

**Remarks:** The specimens of *D. dangila* from the Khasi Hills show a tendency towards

reduction of total size of the fish and in the number of dorsal and anal rays and in overall decrease in the proportion of body depth. The dorsal rays vary from 10-12 (vs 11-13), anal 12-14 (vs 17-18) and the body depth in the total length  $4\frac{1}{2}$  to 5 (vs  $3\frac{1}{2}$  to 4). The longest specimen found is 82 mm against 152 mm the maximum length known for this species (see Day 1889).

#### 5. *Danio (Brachydanio) rerio* (Hamilton)

1822. *Cyprinus rerio* Hamilton, *Fish Ganges*, pp. 323, 390.

**Material:** 2,506 examples, 10 to 41 mm in total length, from fourteen different localities (nos. 1, 4, 5, 6, 7, 9, 10, 20, 21, 23, 26, 27, 29 and 32) were examined.

**Distribution:** Khasi Hills: first record. Elsewhere: India: throughout, Sikkim; Burma.

**Habits:** *D. rerio* is rather uncommon in the Khasi Hills but it occurs upto an altitude of 5,000 ft. It is generally found with *D. dangila*.

**Remarks:** The specimens of *D. rerio* also exhibit certain variations in the Khasi Hills. The number of dorsal rays is 8-9 (vs 9) and anal 12-15 (vs 15-16).

#### 6. *Garra lamta* (Hamilton)

1822. *Cyprinus (Garra) lamta* Hamilton (in part). *Fish Ganges*, Edingburgh, pp. 344, 393.

**Material:** 1 example, 27 mm. in total length, from one locality namely, no. 8 was examined.

**Distribution:** Khasi Hills: first record. Elsewhere: India: Darjeeling and Kumaon Himalayas and Sikkim; Eastern Nepal.

**Habits:** A typical hill-stream fish found adhering to rocky bottom of the river.

#### 7. *Garra lissorhynchus* (McClelland)

1842. *Platycaea lissorhynchus* McClelland, *Calcutta Jour. Nat. Hist.* 2, pp. 587, pl. 16 fig. 2.

**Material:** 17 examples, 25 to 90 mm in total length from two different localities namely, nos. 9 and 14 were examined.

**Distribution:** Khasi Hills. Elsewhere: India:



Brahmaputra system, Assam Himalayas.

*Habits*: A typical hill-stream fish commonly found adhering to rocks under water.

8. **Garra naganensis** Hora

1921. *Garra naganensis* Hora, *Rec. Indian Mus.*, Calcutta, 22, p. 667, pl. 25, figs. 2, 2a.

*Material*: 7 examples, 29 to 105 mm in total length, from two different localities namely, nos. 4 and 9 were examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: Nagaland.

*Habits*: A typical hill-stream fish commonly found adhering to rocks under water, both in streams and the lake.

*Remarks*: The occurrence of *G. naganensis* in Khasi Hills extends the range of distribution of this species considerably westward.

9. **Puntius chola** (Hamilton)

1822. *Cyprinus chola* Hamilton, *Fish Ganges*, pp. 312, 389.

*Material*: 5 examples, 21 to 64 mm in total length, from one locality (no. 4) were examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: throughout; Bangladesh and Pakistan.

*Remarks*: *P. chola* is rare in the Khasi Hills. It is known to grow to 5 inches (128.0 mm) in length (Day 1889) but the longest specimen collected is only 64 mm.

10. **Puntius shalynius** Yazdani & Talukdar

1975. *Puntius shalynius* Yazdani & Talukdar, *J. Bombay nat. Hist. Soc.* 72(1):218-221.

*Material*: 1,739 examples, 9 to 62 mm in total length, from twenty localities (nos. 1, 4, 5, 6, 9, 10, 11, 12, 13, 19, 20, 21, 22, 23, 26, 27, 29, 30, 32 and 35) were examined.

*Distribution*: Khasi Hills (Meghalaya).

11. **Tor putitora** (Hamilton)

1822. *Cyprinus putitora* Hamilton, *Fish Ganges*, pp. 303, 388.

*Material*: 107 examples, 13 to 135 mm in

total length, from three localities (nos. 8, 9 and 33) were examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: Punjab, U.P., Western Himalayas, W. Bengal, Assam, Eastern Himalayas; Pakistan and Bangladesh.

*Habits*: The habits of *T. putitora* are like those of *Acrossocheilus hexagonolepis*.

12. **Tor tor** (Hamilton)

1822. *Cyprinus tor* Hamilton, *Fish Ganges*, pp. 305, 388.

*Material*: 2 examples, 100 to 150 mm in total length, from locality no. 9 were examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: Garo Hills (Meghalaya), Kashmir, throughout the Himalayas, Assam and Sikkim.

*Habits*: The habits of *T. putitora* resemble those of *T. tor*.

Family PSILORHYNCHIDAE

13. **Psilorhynchus balitora** (Hamilton)

1822. *Cyprinus balitora* Hamilton, *Fish Ganges*, pp. 348, 394.

*Material*: 1 example, 31 mm in total length, from one locality (no. 9) was examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: Bengal (N.E.) and Assam (Day 1889) and Burma (Shaw & Shebbeare 1938).

*Remarks*: This is a rare species in the Khasi Hills.

14. **Psilorhynchus homaloptera** Hora & Mukerji

1935. *Psilorhynchus homaloptera* Hora & Mukerji, *Rec. Indians Mus.*, Calcutta, 37, pp. 391, pl. 7, fig. 1-6.

*Material*: 11 examples, 23 to 40 mm in total length, from one locality (no. 9) were examined.

*Distribution*: Khasi Hills; first record. Elsewhere: India: Nagaland and Assam.

## Family COBITIDAE

15. **Lepidocephalus berdmorei** (Blyth)

1860. *Acanthopsis berdmorei* Blyth, *J. Asiat. Soc. Beng.*, 29, pp. 168.

**Material:** 1 example, 59 mm in total length, from one locality namely, no. 21 was examined.

**Distribution:** Khasi Hills, and Shillong (Sehgal 1959). Elsewhere: Moulmein in Burma.

**Remarks:** This species is extremely rare in the Khasi Hills.

16. **Lepidocephalus guntea** (Hamilton)

1822. *Cobitis guntea* Hamilton, *Fish Ganges*, pp. 353, 394.

**Material:** 222 examples, 13 to 64 mm in total length, from twelve different localities namely, nos. 1, 9, 11, 13, 20, 21, 23, 26, 28, 29, 32 and 35 were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: throughout northern India, Bangladesh and Pakistan.

**Habits:** *Lepidocephalus guntea* is found in gravelly or muddy streams and lives on the bottom.

**Remarks:** This species is one of the commonest loach in the Khasi Hills.

17. **Noemacheilus dayi** Hora

1878. *Nemachilus savona* Day, nec Hamilton *Fish. India* pp. 619, pl. CLV, fig. 8.

1937. *Nemachilus dayi*, Hora, *Rec. Indian Mus.*, 37, p. 57.

**Material:** 10 examples, 24 to 58 mm in total length, from one locality (no. 9) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: India: Day (1889) gives "Bengal and N.W. Province". Subsequently this species has been recorded from Madhya Pradesh and Western ghats (Hora 1938) and from Bihar (Das 1939).

**Remarks:** *N. dayi* is a rare species in the Khasi Hills and its occurrence here extends the range of distribution further eastward.

18. **Noemacheilus multifasciatus** Day

1878. *Nemacheilus multifasciatus* Day, *Fish India*, pp. 617.

**Material:** 26 examples, 15 to 115 mm in total length, from one locality namely, no. 9 were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: India: Assam and W. Bengal.

19. **Noemacheilus rupecola inglisi** Hora

1935. *Nemachilus rupecola* var. *inglisi* Hora, *Rec. Indian Mus.*, 37, pp. 58, pl. 3, fig. 9, 10.

**Material:** 56 examples, 19 to 52 mm in total length from seven different localities (nos. 1, 2, 4, 8, 9, 14 and 16) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: India: Assam, West Bengal, Bihar & U.P. (near Himalayan foot-hills).

**Habits:** This species is a typical hill-stream loach which adheres to rocks submerged under water in rapid streams.

**Remarks:** This is one of the commonest loach of the genus *Noemacheilus* in the Khasi Hills. The largest specimen found in this hill is 52 mm long but that recorded elsewhere is about 76 mm.

20. **Noemacheilus sikmaiensis** Hora

1921. *Nemachilus sikmaiensis* Hora, *Rec. Indian Mus.*, 22, pp. 201-202.

**Material:** 12 examples, 20 to 50 mm in total length, from two different localities (nos. 4 & 9) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: India: Manipur; Burma.

**Remarks:** The occurrence of *N. sikmaiensis* in the Khasi Hills extends the known range of distribution of this species considerably westward.

Order Siluriformes

Family SILURIDAE

21. *Ompok bimaculatus* (Bloch)

1797. *Silurus bimaculatus* Bloch, *Syst. Ichth.*, 11, pp. 17, pl. 369.

**Material:** 1 example, 16 mm in total length, from only one locality (no. 6) was examined.

**Distribution:** Khasi Hills; first record. Elsewhere: India: throughout; Sri Lanka, Pakistan, Burma, Malaya, Malay Archipelago, Thailand, Chusan and Yunan.

Family SISORIDAE

22. *Glyptothorax striatus* (McClelland)

1842. *Glyptosternon striatus* McClelland, *Cal. Jour. Nat. Hist.*, 2, pp. 587, pl. vi, fig. 1, 2.

**Material:** 1 example, 145 mm in total length, from one locality (no. 9) was examined.

**Distribution:** Khasi Hills, and Cherrapunjee (Menon 1954). Elsewhere: Sikkim.

Family HETEROPNEUSTIDAE

23. *Heteropneustes fossilis* (Bloch)

1794. *Silurus fossilis* Bloch, *Naturg Ausland, Fische*, 8, pp. 46, pl. 370, fig. 2.

**Material:** 75 examples, 34 to 160 mm in total length, from four different localities (nos. 4, 6, 9 & 20) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: throughout India; Bangladesh, Burma, Pakistan, Sri Lanka, Thailand and Indo-China.

**Remarks:** The largest specimen of this species is known to be of 304 mm (a foot) in length or more (Misra 1962). In the Khasi Hills, however, the longest specimen collected was only 160 mm.

Family CLARIIDAE

24. *Clarias batrachus* (Lin.)

1758. *Silurus batrachus* Linnaeus, *Syst. Nat.*, 1, ed. 10, pp. 305.

1889. *Clarias magur* Day, *Fauna Brit. India, Fish.*, 1, pp. 115, figs. 48 and 49.

**Material:** 3 examples, 25 to 45 mm in total length, from one locality (no. 20) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: Fresh and brackish waters of the plains of India; Bangladesh, Pakistan, Burma; Sri Lanka, Malaya, Malay Archipelago, Thailand, Indo-China, Philippines, Hong Kong and China.

Order Channiformes

Family CHANNIDAE

25. *Channa orientalis* (Bl. & Schn.)

1801. *Channa orientalis* Bloch & Schneider, *Syst. Ichth.*, pp. 496.

1889. *Ophiocephalus gachua* Day, *Fauna Brit. India, Fish.*, pp. 304.

**Material:** 295 examples, 18 to 115 mm in total length, from twenty-one different localities (nos. 1, 2, 4, 5, 9, 10, 13, 16, 17, 20, 21, 23, 24, 25, 26, 27, 28, 29, 31, 32 & 35) were examined.

**Distribution:** Khasi Hills. Elsewhere: India: throughout; Bangladesh, Sri Lanka, Pakistan, Burma, Afghanistan, Malaya, Malay Archipelago, Thailand, Indo-China and China.

**Habits:** *C. orientalis* is one of the commonest species of fish in Khasi hill-streams. It co-exists with *C. stewartii* (Playfair) and lives along the edges of streams having overhanging vegetation.

**Remarks:** *C. orientalis* is known to grow to 203 mm (8 inches) in length (Misra 1962) but the longest specimen collected in the Khasi hill is only 115 mm.

26. *Channa punctata* (Bloch)

1793. *Ophiocephalus punctatus* Bloch, *Naturg. Ausland, Fische*, 7, pp. 139, pl. 358.

**Material:** 2 examples, 84 to 123 mm in



total length, from one locality (no. 6) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: throughout India; Bangladesh, Pakistan, Burma, Sri Lanka, Malaya, China, Tahiti, Polynesia.

**Habits:** This species resembles *C. orientalis* in habit but unlike the latter it has been found only in one stream which had a muddy bottom.

## 27. *Channa sewartii* (Playfair)

1867. *Ophiocephalus stewartii* Playfair, *Proc. Zool. Soc. Lond.*, pp. 14.

**Material:** 152 examples, 13 to 111 mm in total length, from twenty-one different localities (nos. 1, 2, 4, 6, 8, 9, 10, 12, 13, 15, 16, 17, 18, 20, 21, 22, 26, 27, 30, 34 and 35) were examined.

**Distribution:** Khasi Hills. Elsewhere: Bihar, W. Bengal, Assam, Meghalaya (Jaintia Hills).

**Habits:** *C. stewartii* is one of the most common species of fish in Khasi hill-streams. In habits it very much resembles *C. orientalis*.

**Remarks:** *C. stewartii* is known to grow upto 10 inches (Day 1889) and 18 inches (Shaw & Shebbeare 1938) in length but the longest specimen found in Khasi Hills is only 111 mm (4½ inches).

Order Perciformes

Family NANDIDAE

## 28. *Badis badis* (Hamilton)

1822. *Labrus badis* Hamilton, *Fish Ganges*, pp. 70, 368.

**Material:** 10 examples, 14 to 27 mm in total length, from three different localities (nos. 5, 8 & 32) were examined.

**Distribution:** Khasi Hills; first record. Elsewhere: Assam, Nagaland, W. Bengal, Bihar, U.P.; Burma.

**Remarks:** *B. badis* is rather uncommon

species in the Khasi Hills. It lives near the edges of streams and hides under vegetation.

Suborder Mastacembeloidei

Family PILLAIIDAE

## 29. *Pillaia indica* Yazdani

1972. *Pillaia indica* Yazdani, *J. Bombay nat. Hist. Soc.*, 69(1), pp. 134-135.

**Material:** 5 examples, 30 to 60 mm in total length from three different localities namely nos. 2, 5 and 6 were examined.

**Distribution:** Khasi Hills (Meghalaya).

**Habits:** The habits of this newly discovered eel of India have been observed both in its natural habitat as well as in an aquarium where three specimens were kept alive for about a month. It is very inactive and mostly spends its time lying on the bottom either buried in mud or clinging to submerged vegetation. While entangling itself to any branch of aquatic plants, it keeps itself suspended under water with its head facing downward. Its swimming and crawling movements resemble those of the anguilliform fishes.

## DISTRIBUTIONAL PATTERN

The distributional pattern of fishes in the Khasi Hills is given in Table 1. Groups I and II localities correspond to locality groupings mentioned earlier under 'collecting localities'. Selected localities correspond to streams and lake where field observations are recorded.

The distributional pattern of the fish fauna of Khasi Hills shows that it is influenced by differences in altitude as well as in habitat. The effect of altitude on distribution of species is shown in column II of the table. It shows that species follow some pattern with regard to their occurrence and their number suddenly falls to nearly 1/3rd at elevations over 4,000 ft. Out of 29 species, 18

TABLE 1

SHOWING DISTRIBUTIONAL PATTERNS OF FISHES IN THE KHASI HILLS. GROUP I AND GROUP II RESPECTIVELY REPRESENT 18 LOCALITIES BETWEEN 3,000 AND 4,000 FT ALTITUDES AND 17 LOCALITIES BETWEEN 4,500 AND 5,000 FT ALTITUDES.

| I<br>Name of species                              | II<br>Total number of localities, where found |          | III<br>Distribution of species in selected localities |   |   |   |   |          |   |   |   |   |
|---|---|----------|---|---|---|---|---|----------|---|---|---|---|
|   | Group I                                       | Group II | Group I   |   |   |   |   | Group II |   |   |   |   |
|   |   |          | A   | B | C | D | E | F        | G | H |   |   |
| 1. <i>Acrossocheilus hexagonolepis</i> (McClell.) | 2   | -        | -   | - | - | + | + | -        | - | - | - | - |
| 2. <i>Cyprinus carpio</i> Lin.                    | 1   | -        | -   | - | - | - | - | -        | - | - | - | - |
| 3. <i>Danio aequipinnatus</i> (McClell.)          | 6   | -        | +   | + | + | - | - | -        | - | - | - | - |
| 4. <i>Danio dangila</i> (Ham.)                    | 8   | 10       | +   | + | - | + | + | +        | + | + | + | + |
| 5. <i>Danio (Brachydanio) rerio</i> (Ham.)        | 7   | 7        | +   | + | + | - | + | +        | + | + | + | + |
| 6. <i>Garra lanta</i> (Ham.)                      | 1   | -        | -   | - | - | - | - | -        | - | - | - | - |
| 7. <i>Garra lissorhynchus</i> (McClell.)          | 2   | -        | -   | - | - | - | + | -        | - | - | - | - |
| 8. <i>Garra naganensis</i> Hora                   | 2   | -        | -   | + | - | - | + | -        | - | - | - | - |
| 9. <i>Puntius chola</i> (Ham.)                    | 1   | -        | -   | + | - | - | - | -        | - | - | - | - |
| 10. <i>Puntius shalynius</i> Yazdani & Talukdar   | 9   | 11       | +   | + | + | - | + | +        | + | + | + | + |
| 11. <i>Tor puitora</i> (Ham.)                     | 2   | 1        | -   | - | - | - | + | -        | - | - | - | - |
| 12. <i>Tor tor</i> (Ham.)                         | 1   | -        | -   | - | - | - | + | -        | - | - | - | - |
| 13. <i>Psilorhynchus baliota</i> (Ham.)           | 1   | -        | -   | - | - | - | + | -        | - | - | - | - |
| 14. <i>Psilorhynchus homaloptera</i> Hora         | 1   | -        | -   | - | - | - | + | -        | - | - | - | - |
| 15. <i>Lepidocephalus berdmorei</i> Blyth         | -   | 1        | -   | - | - | - | - | -        | + | + | + | + |
| 16. <i>Lepidocephalus guntea</i> (Ham.)           | 4   | 8        | -   | - | - | - | + | +        | + | + | + | + |
| 17. <i>Noemacheilus dayi</i> Hora                 | 1   | -        | -   | - | - | - | + | +        | + | + | + | + |
| 18. <i>Noemacheilus multifasciatus</i> Day        | 1   | -        | -   | - | - | - | + | +        | + | + | + | + |
| 19. <i>Noemacheilus rupicola inglisi</i> Hora     | 7   | -        | -   | + | - | + | + | +        | + | + | + | + |
| 20. <i>Noemacheilus sikimensis</i> Hora           | 2   | -        | -   | + | + | - | + | +        | + | + | + | + |
| 21. <i>Ompok bimaculatus</i> (Bloch)              | 1   | -        | +   | - | - | - | - | -        | - | - | - | - |
| 22. <i>Glyptothorax striatus</i> (McClell.)       | 1   | -        | -   | - | - | - | - | -        | - | - | - | - |
| 23. <i>Heteropneustes fossilis</i> (Bloch)        | 3   | 1        | -   | + | - | - | + | +        | + | + | + | + |
| 24. <i>Clarias batrachus</i> (L.)                 | -   | 1        | -   | - | - | - | - | -        | - | - | - | - |
| 25. <i>Channa orientalis</i> (Bl. & Schn.)        | 9   | 12       | -   | + | + | + | + | +        | + | + | + | + |
| 26. <i>Channa punctata</i> (Bloch)                | 1   | -        | +   | - | - | - | - | -        | - | - | - | - |
| 27. <i>Channa stewartii</i> (Playfair)            | 13  | 8        | +   | + | - | + | + | +        | + | + | + | + |
| 28. <i>Badis badis</i> (Ham.)                     | 2   | 1        | -   | - | + | + | - | -        | - | - | - | - |
| 29. <i>Pillaia indica</i> Yazdani                 | 3   | -        | +   | - | + | + | - | -        | - | - | - | - |

Abbreviations: A = Umsning stream, B = Umran stream, C = Umtham stream, D = Sumer stream, E = Barapani lake,

F = Umsning stream, G = Mawpat stream, H = Mylliem stream.



namely, nos. 1, 2, 3, 6, 7, 8, 9, 12, 13, 14, 17, 18, 19, 20, 21, 22, 26 and 29 are restricted in distribution to group I localities and two nos. 15 and 24 to group II localities. Altogether 11 species occur in group II localities; of these 9 species (nos. 4, 5, 10, 11, 16, 23, 25, 27 & 28) are also found equally commonly in group I localities. Species nos. 15 and 24 which also occur fairly commonly in the plains indicate the possibility of discontinuous altitudinal distribution. Some ecological factors such as temperature, pressure, oxygen and food may be effective in controlling the altitudinal distribution of species. Investigation of these factors is not attempted, for, it is beyond the scope of the present study.

The effect of habitat on distribution of species in certain localities is shown in column III of the Table. It shows that number and composition of species differs considerably between streams and lake. We shall examine below how these differences are correlated with habitats and habits of species.

#### *Umsning stream:*

The stream at Umsning is nearly 2 metres wide and about 1 metre deep. It has submerged weeds at various places and overhanging vegetation along the edges. The bottom is mostly muddy and the current is slow.

Nine species, nos. 3, 4, 5, 10, 21, 23, 26, 27 and 29, are found in this stream.

This stream provides quite a suitable habitat for species living on the bottom or living near the edges of stream. *H. fossilis*, *O. bimaculatus* and *P. indica* which by habit prefer a muddy bottom are well suited for this type of habitat. *Danio* spp. and *Puntius shalynius* prefer to live near the surface along the edges amongst overhanging vegetation and *Channa* spp. spend most of the time near the edges of stream under dense vegetation.

#### *Umran stream:*

The stream at Umran is about 6 metres wide and 2-3 metres deep with overhanging vegetation along the edges. The bottom is mostly rocky but at various places the bed is sandy/muddy with big boulders scattered all over. The water is clear and fast running.

Eleven species, nos. 3, 4, 5, 8, 9, 10, 19, 20, 23, 25 and 27, are found in this stream.

The composition of species here differs from that of Umsning stream mainly by the occurrence of species of *Garra* and *Noemacheilus*. This is expected because in Umran stream the current is fast and the bottom is largely rocky. Species of *Garra* and *Noemacheilus* which possess organs of adhesion to rocks are very well adapted to life in such a habitat.

#### *Umtham stream:*

A tributary of Umtru river, hardly half a metre deep with sandy bottom with pebbles scattered all over. Tall trees present on its banks cast shadows over the stream. The water is clear and slow running. In some parts of the stream, fallen leaves from trees decay in the water.

Six species nos. 3, 5, 10, 25, 28 and 29, are found in this stream.

A very shallow stream it offers limited scope and the number of species is rather poor. Species of *Channa* and *Pillaia* which by habit hide under vegetation or mud occur and other species which have a rather wide range of habitat preference manage to live near the water surface along the edges.

#### *Sumer stream:*

Sumer stream is about 5 metres wide and 1-2 metres deep, the water clear and running, and bottom sandy/muddy near the edges and sandy and gravelly elsewhere. It has overhanging vegetation along the edges.

Six species (nos. 1, 4, 19, 25, 27 and 29) occur in this stream.

Although the number of species here is the same as that in Umtham stream, the composition of species is different. The shallowness of this stream and limited scope for life accounts for its poor fish-fauna, other factors such as running water and sandy and gravelly bottom provide suitable habitat to species of *Noemacheilus* and the young ones of *Accrossocheilus*. Near the edges, muddy bottom and overhanging vegetation provide fairly suitable habitat to species of *Channa* and *Pillaia* as well as to *Danio dangila* which lives near the water surface.

#### *Barapani lake:*

The Barapani lake is one of the largest perennial water reservoirs in the Khasi Hills, situated at 3,500 ft altitude with an area of c. 5 sq km. It is connected with Umiam river and various other streams. Near the junctions of streams and lake there are strong currents and the bottom is mostly gravelly. In other parts of the lake water is still and the bottom is generally sandy. The maximum depth of the lake is about 20 metres.

Nineteen species, nos. 1, 4, 5, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 27, have been found in the lake. Of these only six, nos. 12, 13, 14, 17, 18 and 22, are restricted to the lake and have not been found in any of the streams.

Unlike the streams which show a great deal of seasonal variation in respect of ecological conditions, the lake provides a more or less constant environment and this factor and variety of habitats accounts for a fairly rich and diversified fish fauna.

#### *Umshing stream:*

There is a dam across this stream at Umshing. The section of the stream before the dam

is 3-4 metres deep, with muddy bottom and more or less still water. The part after the dam is hardly 1 metre deep with gravelly bed having boulders scattered all over and fast running water. Overhanging vegetation is present along the edges in both parts.

Seven species, nos. 4, 5, 10, 16, 19, 25 and 27, are found in this stream, which provides habitat suitable for species living on muddy bottom (e.g. *Lepidocephalus guntea*), on gravelly bottom in running stream (*N. rupicola inglisi*), and along the edges of the stream with overhanging vegetation (e.g. *Danio* spp., *Puntius shalynius* and *Channa* spp.).

#### *Mawpat stream:*

The stream is hardly 2 metres wide and half a metre deep with clear and running water. Its bottom is muddy with pebbles scattered all over. Dense overhanging vegetation is present along the edges.

Seven species, nos. 4, 5, 10, 15, 16, 25 and 27 occur in this stream which belongs to group II localities.

Except for the lack of rocky bottom or rock boulders in its bed, the stream provides habitat more or less similar to that of Umshing and explains why excepting the species of *Noemacheilus* which is restricted to group I localities in the Khasi Hills, the fish-fauna here resembles so much that of Umshing stream.

#### *Myllem stream:*

The Myllem stream is about 5 metres wide and nearly 1½ metres deep with dirty and slow running water. Its bottom is generally muddy with decaying organic matter. In some parts of this stream the bed is gravelly and water clear. Overhanging vegetation is present along the edges.

Six species, nos. 4, 5, 10, 16, 25, 28, are found in this stream of group II localities. Amongst these three was an abundant popul-

ation of *Lepidocephalus guntea*.

Except for the presence of *Badis badis* and absence of *Lepidocephalus berdmorei*, the composition of fish-fauna here is similar to that of Mawpat stream, which also has a rather similar habitat. However, the presence of *B. badis* and absence of *L. berdmorei* cannot be explained. An unusual abundance of *L. guntea* appears to be related to presence of decaying organic matter which forms the food of this species.

#### CONCLUSION

Altogether 37 species belonging to 12 different families are hitherto known from Khasi Hills. Of these, 8 species reported earlier from this hill have not been found in any of the 35 localities surveyed. Out of 29 species dealt with in this paper, 21 spp. are first distributional records for Khasi Hills. Nearly one third of the fish-fauna of this hill comprises of Cyprinidae and one fifth of Cobitidae.

The drainages of the Khasi Hills form a part of the Brahmaputra drainage system of the Himalayas. Out of 37 spp., 33 spp. are commonly found in the Brahmaputra drainage. Of the remaining 4 spp., 2 spp., namely, *Pillaia indica* and *Puntius shalynius* are endemic and one species, *Cyprinus carpio* is introduced. The fourth species namely, *Botia almorhae*, which is reported to occur in this hill, is found in the drainages of Western Himalayas.

The fishes of Khasi Hills show a pattern of distribution related to the altitude and habitat of the species. Out of 29 species that have been found to occur in 35 different localities, only 11 species occur at elevations over 4,000 ft. The absence of remaining 18 species at altitudes over 4,000 ft may be due to some bio-physical factors which act as a barrier.

The streams in Khasi Hills provide a fairly good range of habitat preferred by various species. The differences in the composition of species between streams above and below 4,000 ft altitude appear largely correlated with differences in habitat and habits of species. However, differences in distributional pattern of some species appear to be correlated with factors other than habitat which is beyond the scope of the present study.

Species with wide range of habitat preference have wider distribution and those with strict choice of habitat are restricted to a few localities only. The bottom-living species of *Garra*, *Psilorhynchus*, *Lepidocephalus*, *Noemacheilus*, *Glyptothorax*, *Ompok* and *Pillaia* are much affected by the condition of the bed of the stream in comparison with species which mostly live near the water surface e.g. species of *Danio*, *Puntius* or species which live partly near the water surface and partly on the bottom amongst dense vegetation e.g. species of *Channa* and *Badis*. This observation is supported by the fact that most common and widely distributed species in the Khasi Hills are *Danio dangila* and *Puntius shalynius*, *Channa orientalis* and *Channa stewartii*; other species which may be called fairly common are *Danio rerio* and *Lepidocephalus guntea*.

It is observed that in the Khasi Hills some species such as *Danio aequipinnatus*, *D. dangila*, *D. rerio*, *Lepidocephalus guntea*, *Noemacheilus rupicola inglisi*, *Heteropneustes fossilis*, *Channa orientalis* and *C. stewartii* do not grow to their usual size. The longest mature specimens of most of these species have been found to be much shorter than those normally seen in the plains. This factor appears to be of some adaptive value, for, the large size would be a handicap in hills-streams which are generally very shallow.



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